CLAIMS

1. A hydrogen generation apparatus comprising:

a boiler;

a pump delivering a feedstock into said boiler;

a reactor for producing hydrogen from said feedstock;

a burner in thermal communication with said reactor, said burner receiving a catalytically combustible mixture of feedstock and a combustible gas, said feedstock being metered to said burner by a first control valve;

a waste gas outlet in full communication with said burner;

a reactor pressure sensor monitoring a reactor pressure within said reactor;

a second stage delivering a purified product gas to a product outlet and a rafinate to a rafinate outlet;

a combustion gas inlet delivering said combustible gas to said burner; and

a computer controller receiving data from said first pressure sensor and controlling said first control valve.

2. The apparatus of claim 1 wherein said purified product gas is hydrogen.

3. The apparatus of claim 1 wherein said purified product gas is carbon dioxide.

4. The apparatus of claim 1 wherein said rafinate outlet is in fluid communication with said burner.

5. The apparatus of claim 1 wherein said feedstock is an aqueous organic feedstock and said secondary stage is a water gas step membrane reactor.

6. The apparatus of claim 5 wherein said aqueous organic feedstock is selected from the group consisting of: aqueous mixtures of -alcohols, -ketones, -alkanes, -alkenes, -alkynes, -aldehydes and aliphatics.

7. The apparatus of claim 1 wherein said feedstock is ammonia and said secondary stage is a flat plate heat exchanger operating as a purifier.

8. The apparatus of claim 1 wherein said reactor comprises a flat plate heat exchanger having a lower channel passing reacting feedstock therethrough and an upper channel passing heated gases therethrough in a direction non-concurrent with flow in the lower channel.

9. The apparatus of claim 5 wherein said water gas step membrane reactor is a flat plate heat exchanger having reactant channels containing catalyst media therein and channels containing said purified gas product and having a purified product permeable gas membrane therebetween.

10. The apparatus of claim 9 wherein the membrane is a metal alloy.

11. The apparatus of claim 9 wherein the membrane is a polymer.

12. The apparatus of claim 1 further comprising a heat exchanger transferring heat between said purified product gas and said combustible gas.

13. The apparatus of claim 1 further comprising a second pressure sensor monitoring a product gas pressure in fluid communication with said product outlet.

14. The apparatus of claim 1 further comprising a second control valve metering said combustible gas to said burner, said second control valve responding to signal generated by said computer controller.

15. The apparatus of claim 1 further comprising an oxygen sensor monitoring oxygen content within said waste gas outlet and communicating the oxygen content to said computer controller.

16. A process for forming hydrogen from a feedstock comprising the steps of:

preheating a feedstock;

providing said feedstock to an exothermic reaction reactor;

allowing sufficient resonance time for said feedstock in said reactor to undergo an endothermic reaction to yield hydrogen and an endothermic reaction product;

transferring said hydrogen and said endothermic product to a secondary stage water gas step membrane reactor operating at a lower temperature than said reactor; and

collecting from secondary stage a purified hydrogen flow and a rafinate gas stream.

17. The process of claim 16 wherein said feedstock is preheated within a pump supplied boiler.

18. The process of claim 17 further comprising the step of metering said feedstock to a burner in thermal communication with said reactor so as to maintain said reactor at a temperature promoting the endothermic reaction.

19. The process of claim 18 further comprising the step of monitoring reactor temperature and communicating reactor temperature to a computer controller.

20. The process of claim 19 further comprising the step of monitoring reactor pressure and communicating reactor pressure to said computer controller.

21. The process of claim 16 further comprising the step of combusting said rafinate gas flow in said burner to yield a waste gas stream.

22. The process of claim 21 further comprising the step of heat exchanging between said waste gas stream and said feedstock so as to preheat said feedstock prior to said reactor.

23. The process of claim 16 further comprising the step of providing a combustible gas flow to said burner.

24. The process of claim 22 further comprising the step of providing feedstock to said burner so as to heat said reactor.

25. The process of claim 23 wherein said combustible gas flow is provided stoichiometrically burn said rafinate.